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| **Status** | Beendet |
| **Begonnen** | Mittwoch, 4. Juni 2025, 12:48 |
| **Abgeschlossen** | Mittwoch, 4. Juni 2025, 13:07 |
| **Dauer** | 18 Minuten 43 Sekunden |
| **Bewertung** | **10,00** von 10,00 (**100**%) |

**Frage 1**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the ground formula $F := c \neq f(g(a)) \wedge f(a) = a \wedge f(f(a)) = f(g(c))$ in the theory of equality $\mathcal{T}_E$. Which one of the answers below is correct?

- a. $F$ is valid.
- b. $F$ is unsatisfiable.
- c. $F$ is satisfiable, but not valid. ✓

**Frage 2**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the following formula $F := f(g(c)) = g(f(b)) \wedge g(f(b)) \neq f(f(d)) \wedge b = f(d)$. Which of the following statements hold?

**Note:** More than one answer might be correct.

- a. $F \wedge (g(b) = g(d) \wedge g(b) \neq g(c))$ is satisfiable. ✓
- b. $F \wedge (g(c) = f(c) \vee g(c) = f(b))$ is satisfiable. ✓
- c. All formulas in the other options are unsatisfiable.
- d. $F \wedge (d = b \wedge g(c) = f(b))$ is satisfiable. ✓

**Frage 3**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := q(f(a), f(c)) \wedge f(c) \neq a \wedge p(c, f(c)) \wedge b = f(b)$ in the theory $\mathcal{T}_E$ of equality and the fresh symbols $f_p$, $f_q$ and $t$. Which of the following formulas is equisatisfiable to $F$?

- a. $f(c) \neq a \wedge b = f(b)$
- b. $f_q(f(a), f(c)) \neq t \wedge f(c) \neq a \wedge f_p(c, f(c)) \neq t \wedge b = f(b)$
- c. $f_q(f_p(a), f_q(c)) = t \wedge f_p(c) \neq a \wedge f_p(c, f_q(c)) = t \wedge b = f(b)$
- d. $f_q(f(a), f(c)) = t \wedge f(c) \neq a \wedge f_p(c, f(c)) = t \wedge b = f(b)$ ✓

**Frage 4**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(write(A, c, c), c) = b \wedge c \neq b$ in the theory of arrays $\mathcal{T}_A$ where $b, c$ are constants and $A$ is an array constant. Which one of the answers below is correct?

a. $F$ is satisfiable, but not valid.

b. $F$ is unsatisfiable. ✓

c. $F$ is valid.

**Frage 5**

Richtig

Erreichte Punkte 1,00 von 1,00

Which of the following formula is valid in the theory $\mathcal{T}_A$ of arrays where $a, b, c, d$ are constants and $A$ is an array constant?

a. $read(write(A, c, c), d) = a \wedge d = b \implies a = b$

b. $read(write(A, a, a), b) = c \wedge b = b \implies b = d$

c. $read(write(A, d, d), a) = d \wedge d = a \implies b = d$

d. $read(write(A, c, a), c) = d \wedge a = b \implies d = a$ ✓

**Frage 6**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(write(A, d, b), c) = a$ in the theory $\mathcal{T}_A$ of arrays where $a, b, c, d$ are constants and $A$ is an array constant. Which formula is valid:

a. $F \wedge d \neq a \implies read(A, c) = a$

b. $F \wedge d \neq b \implies read(A, c) = a$

c. $F \wedge d \neq c \implies read(A, c) = a$ ✓

**Frage 7**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(A, a) \neq read(B, g(b)) \wedge f(b) \neq f(b) \wedge f(c) \neq f(b)$ in the theory $\mathcal{T}_A$ of arrays and $f_A$, $f_B$ and $t$ are fresh symbols. Which of the following formulas is equisatisfiable to $F$?

a. $f_A(a) \neq t \wedge f(b) \neq f(b) \wedge f(c) \neq f(b)$

b. $f(a) \neq f(g(b)) \wedge f(b) \neq f(b) \wedge f(c) \neq f(b)$

c. $f(b) \neq f(b) \wedge f(c) \neq f(b)$

d. $f_A(a) \neq f_B(g(b)) \wedge f(b) \neq f(b) \wedge f(c) \neq f(b)$ ✓

**Frage 8**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the following formula
$F := read(A, y+3) \neq f(a+1) \wedge (c+3 \neq write(A, x, 1) \vee f(x) = f(x)) \wedge read(A, x+3) \neq read(A, y+3)$ in the theory of equality $\mathcal{T}_E$, arrays $\mathcal{T}_A$ and linear integer arithmetic $\mathcal{T}_{\mathbb{Z}}$. Which one of the following answers is a correct Boolean abstraction of $F$?

**Note:** Use atoms to denote positive literals. For instance, the atom $p$ is the abstraction of $a = b$. Do not use $p$ as the abstraction of $a \neq b$.

- a. $p_1 \wedge (p_2 \vee p_3) \wedge p_4$
- b. $\neg p_1 \wedge (\neg p_2 \vee p_3) \wedge \neg p_4$ ✓
- c. $\neg p_1 \wedge (\neg p_2 \wedge p_3) \wedge \neg p_4$
- d. $\neg p_3 \wedge (\neg p_2 \vee p_3) \wedge \neg p_4$

**Frage 9**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the set of formulas $\mathcal{F}$ as given below, in which the formulas might not belong to a single theory. Furthermore, let $a, b, c, d$ be constants.

$$\mathcal{F} = \{\ g(c) = a,\ a+1 = d+1,\ write(A, b, a) = c\ \}$$

Which constant symbols are shared among different theories?

**Note:** Multiple answers might be correct.

- [x] $a$ ✓
- [ ] $b$
- [x] $c$ ✓
- [ ] $d$

**Frage 10**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the set of formulas $\mathcal{F}$ as given below, in which the formulas might not belong to a single theory.

$$\mathcal{F} = \{\ g(c+8) = h(a+8) + 8,\ (c + a = h(a) + 8),\ read(A, y+8) \neq x)\ \}$$

Which variables and equalities need to be introduced to allow theory separation?

- $c_1 = c + 8,\ c_2 = a + 8,\ c_3 = h(a+8) + 8,\ c_4 = c + a,\ c_5 = h(a) + 8$
- $c_1 = c + 8,\ c_2 = a + 8,\ c_3 = h(c_2),\ c_4 = c_3 + 8,\ c_5 = c + a,\ c_6 = h(a),\ c_7 = c_6 + 8,\ c_8 = y + 8$ ✓
- $c_1 = c + 8,\ c_2 = a + 8,\ c_3 = h(a+8) + 8,\ c_4 = c + a,\ c_5 = h(a) + 8,\ c_6 = y + 8$
- $c_1 = c + 8,\ c_2 = a + 8,\ c_3 = h(c_2) + 8,\ c_4 = c + a,\ c_5 = h(a) + 8,\ c_6 = y + 8$